



ONTARIO MINISTRY OF THE ENVIRONMENT
ACHIEVEMENTS AND FUTURE DIRECTIONS IN GREAT LAKES
CLEAN-UP AND DRINKING WATER PROTECTION

INTRODUCTION

The Great Lakes are vital to the citizens of Ontario and are an important resource to all of Canada. More than six million Canadians live in the Great Lakes basin. Add this to the U.S. population in the basin, and there are nearly 37 million people dependent on this waterway as a major source of water supply, employment and recreation.

Recognizing their shared responsibility in the use and protection of the lakes, Canada and the United States created the International Joint Commission in 1909. Between 1912 and 1969, the IJC conducted several studies of Great Lakes pollution leading to the signing of the Great Lakes Water Quality Agreement of 1972. This marked the beginning of a major international clean-up of Lakes Erie and Ontario, the initiation of studies on pollution from land use activities and the introduction of new initiatives in toxic substances management.

Ontario has long been at the forefront in the assault on Great Lakes pollution and in the development and protection of drinking water supplies. Since 1972, the Ministry of the Environment and, for 15 years prior to that, the Ontario Water Resources Commission have been instrumental in the funding, construction and operation of water and sewage treatment facilities, in the introduction and enforcement of environmental regulations, in the continued development and refinement of water quality objectives and in the assessment and resolution of water use conflict.

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WATER QUALITY AND QUANTITY MANAGEMENT

The water quality management goal of the Ministry of the Environment is: "To ensure that the surface waters of the Province are of a quality which is satisfactory for aquatic life and recreation". The Provincial Water Quality Objectives (PWQO), a set of criteria designed to protect these uses, are published in the booklet "Water Management: Goals, Policies, Objectives and Implementation Procedures of the Ministry of the Environment". The Ministry achieves this goal through programs and actions provided for in the Ontario Water Resources Act, the Environmental Protection Act and other legislation. Ministry approval of waste discharges and of treatment works is required under these statutes.

On the water quantity side, the Ministry of the Environment goals are directed toward the fair sharing of the available supply to protect both withdrawal and in-place uses of surface water, and to ensure a fair sharing and conservation of ground water.

The permit to take water program, authorized under Ontario Water Resources Act, is the primary water quantity management tool employed by the Ministry of the Environment. All water users withdrawing or impounding over 50,000 litres on any one day of the year are required to obtain a Permit. There are currently approximately 6000 Permits in force authorizing the withdrawal or impoundment of 14.4 billion litres per day.

The Provincial Water Quality Objectives ensure protection of other uses including potable water supplies. Drinking water quality is further protected through requirements for additional purification and disinfection of these supplies prior to delivery to the consumer.

CONTROLLING MUNICIPAL SEWAGE

PROGRAMS:

With the creation of the OWRC in 1956, Ontario launched a massive program to provide basic sewage services throughout the province. The program has continued under the direction of the Ministry of the Environment since 1972 and construction of new plants in Ontario is now virtually complete. Provision of these facilities has been instrumental in protecting the public from the outbreak of waterborne disease. Minor plant upgrading is ongoing and emphasis has switched to ensure existing plants meet Ministry effluent requirements through good operations and maintenance.

There are presently 308 sewage treatment plants in the Ontario portion of the Great Lakes Basin. With an approximate capacity of 5.2 million cubic metres per day these facilities serve 6.4 million people. This represents a 36% increase from the 4.7 million people serviced in 1970. Secondary treatment or better is now provided at 283 plants serving 88% of the total capacity. Fifteen years ago, only 77% of plant capacity received this level of treatment. Phosphorus removal facilities are installed at 230 plants representing 97% of the overall capacity. Total phosphorus inputs from Ontario plants have been reduced by 77% or 5400 tonnes since 1970. This constitutes a major step in the battle against the nutrient enrichment problem and resultant algal "blooms" which had plagued Lakes Erie and Ontario.

The total investment in the construction of municipal sewage collection and treatment facilities in Ontario has been in excess of \$3.3 billion since 1968. Of this an estimated 80% or \$2.7 billion was devoted to the Great Lakes Basin.

MUNICIPAL PHOSPHORUS LOADING REDUCTIONS

	1968	1983	Change
POPULATION SERVED	4.7 Million	6.4 Million	+36%
PHOSPHORUS LOAD TONNES/YR	7000	1600	-77%
AVERAGE EFFLUENT CONCENTRATION MG/L	6	1.0	-83%

ENVIRONMENTAL IMPROVEMENTS:

Accomplishments over the past 15 years in upgrading sewage treatment facilities throughout the Great Lakes basin have resulted in significant environmental improvements.

Recent investigations by the Ministry and other agencies show that:

- Shoreline bacterial levels adjacent to Ontario towns and cities around the Great Lakes are greatly reduced from levels observed in the 60's and in most cases comply with objectives.
- The median total phosphorus concentration in open waters of Lake Ontario has declined to 13.5 ug/L, the lowest reported in the last 13 years. Improvements are also reflected in nearshore areas such as Hamilton Harbour, Toronto Harbour and Bay of Quinte where phosphorus levels have declined by up to 50% over the same period.
- Improving conditions in Lake Ontario are also indicated by a shift toward healthier (less enriched) phytoplankton (algae) species composition.
- Measurable reductions in oxygen depletion problems have taken place in Toronto and Hamilton harbours and in the Bay of Quinte.
- Local water treatment plant efficiencies have improved because of reduced algal growth in the Bay of Quinte.
- Total phosphorus concentrations have declined 35% in western Lake Erie since 1974.
- Nuisance growths and shoreline accumulation of cladophora (algae) in eastern Lake Erie are down significantly.

- There is some evidence of a reduction in the severity of oxygen depletion in the deep portions of the central basin of Lake Erie.
- In Lake Huron and Georgian Bay, the total phosphorus concentrations (5 ug/L) have remained unchanged since 1971. Thus, the non-degradation objective of the 1978 Great Lakes Water Quality Agreement is being met. Phosphorus levels in some embayment areas of Georgian Bay remain higher than open water levels due to nearby municipal inputs and limited exchange with the open water. They have, however, been stable since 1973.
- In Lake Superior, the average total phosphorus level has stayed around 5 ug/L, providing a high level of protection against aesthetic deterioration and satisfying the non-degradation objective.

CONTROLLING INDUSTRIAL POLLUTION

PROGRAMS:

MOE initiatives have demonstrated that environmental improvement and industrial progress can be compatible. Significant reductions in waste discharges have occurred over the past fifteen years in spite of overall production increases by industry and recurring recessionary factors in the economy. This has been achieved through the construction of treatment facilities, through process changes and through replacement of older industrial production facilities with new "environmentally clean" plants incorporating the latest water recycling, material conservation and energy saving measures. Following are highlights of achievements made by three major industrial sectors from 1967 to 1981/82, at an estimated pollution control expenditure of \$500 million. Similar overall progress and expenditures have been made in the other industrial sectors such as petrochemical, metal finishing and fabrication, and food processing.

PETROLEUM REFINERIES

Over the past 15 years, two new refineries have been constructed (start-up in 1977) incorporating state-of-the-art environmental controls, two older refineries have closed, and the other refineries have installed secondary (biological), and in some cases tertiary (carbon filtration) wastewater treatment systems. Together, these activities have resulted in large reductions in the discharges of oxygen demanding wastes, suspended solids, oil and grease, phenolics and ammonia even though production capacity has risen significantly over the period.

PETROLEUM REFINERIES

	<u>1967</u>	<u>1981</u>	<u>Change</u>
NUMBER OF REFINERIES	7	8	+ 1
PRODUCTION 1000 BBLS/DAY	403	633	+ 57%
SUSPENDED SOLIDS KG/DAY	13300 (1972-73)	2170	- 84%
OIL & GREASE KG/DAY	4100	514	- 88%
AMMONIA - N KG/DAY	2320	313	- 87%
PHENOLICS KG/DAY	102	10.2	- 90%

STEEL

There are 3 primary steel producers in Ontario, two in Hamilton and one at Sault Ste Marie. Process improvements, better water management practices and waste treatment facilities have brought about significant reductions in the discharge of suspended solids, oil and grease, ammonia, phenolics and cyanide. The Ministry is requiring additional improvements to be made with programs at the Sault mill to be completed by 1990.

STEEL

	<u>1967</u>	<u>1982</u>	<u>Change</u>
NUMBER OF MILLS	3	3	
PRODUCTION TONNES/YR	8 Million	10.7 Million	+ 34%
SUSPENDED SOLIDS KG/DAY	126000	35500	- 72%
AMMONIA - N KG/DAY	23880	8280	- 65%
OIL & GREASE KG/DAY	30000	3380	- 89%
PHENOLICS KG/DAY	2730	358	- 87%
CYANIDE KG/DAY	2370	338	- 86%

PULP AND PAPER

Substantial decreases in loadings of oxygen-demanding substances and suspended solids, along with reduced effluent toxicity to fish, have resulted from a combination of mill modernization, better water management practices, process changes and installation of waste treatment facilities. Existing MOE control orders require further improvements to achieve compliance with the Federal Pulp and Paper Effluent Regulations by 1987.

PULP AND PAPER

	<u>1967</u>	<u>1982</u>	<u>Change</u>
NUMBER OF MILLS	22	22	
PRODUCTION TONNES/DAY	7350	8540	+ 16%
BOD ₅ * TONNES/DAY	610	315	- 48%
SUSPENDED SOLIDS TONNES/DAY	375	82	- 78%

*a measure of oxygen - demanding substances

ENVIRONMENTAL IMPROVEMENTS:

Achievements in reducing waste loads from these and other industrial sources along with controls on the manufacture and use of a number of chemical compounds in both Ontario and the Great Lakes States have resulted in corresponding improvements in the Great Lakes environment. Notable among the changes observed by the Ministry and others are:

- Declining levels of PCB's in sport fish from Lake Ontario, Lake Erie, Lake Huron, Georgian Bay and Lake Superior
- Declining inputs of PCBs, mirex, DDT, chlorinated benzenes and mercury from the Niagara River to Lake Ontario since the mid 1970's as evidenced by sediment and fish data
- Significant reductions in levels of phenolics, bacteria and phosphorus in the Niagara River
- Improvements in species diversity and numbers of bottom dwelling organisms which are important to the fish community along the Ontario shoreline of both the St. Clair and Detroit Rivers as well as in the western basin of Lake Erie
- Achievement of the water quality objective for phenolic substances and overall reduction in the zone of influence of petroleum refinery and petrochemical plant discharges on the St. Clair River
- Elimination or reduction of aesthetic degradation, i.e. oil films, discoloration, and floating solids, adjacent to industrial plants
- Reductions in mercury concentrations in fish to levels where commercial catches were resumed in the western basin of Lake Erie in 1975 and for certain species from Lake St. Clair in 1980
- Declining phenol, cyanide and ammonia levels in the St. Marys River

- Reductions in the zone of influence on water, sediment and biota of pulp mill discharges at all mill locations on Lake Superior

DRINKING WATER SUPPLY AND PROTECTION

As a result of major program initiatives by the OWRC and MOE most of the population in the Ontario Great Lakes basin is now served by communal water treatment and supply systems. Extension of service to the few remaining serviceable communities is continuing. Emphasis has, therefore, shifted to the optimization of existing plant operations and the upgrading of sub-standard facilities.

All water supply systems in Ontario are required to have acceptable treatment processes which ensure that the potable water produced meets the intent and limits set out in the Ontario Drinking Water Objectives. For water works which utilize surface water as a source of raw water, the standard treatment processes consist of chemical coagulation-flocculation, filtration and disinfection. For water works which utilize ground water, the standard treatment consists of disinfection.

There are presently 428 water treatment plants in the basin with an approximate capacity of 9.1 million cubic metres per day, sufficient to serve a population of 7.4 million people. Eighty-eight percent of the population obtain their drinking water from surface water supplies. Total investment in the construction of municipal water treatment and distribution facilities in Ontario has been in excess of \$1.5 billion since 1968. Of this, an estimated 80% or \$1.2 billion was directed to Great Lakes basin communities.

Beyond these statistics, the real benefits of the provincial water supply and treatment initiatives have been maximum public protection from the transmission of waterborne disease and the assured availability of a high quality supply to meet all household and community needs.

FUTURE DIRECTIONS

The large scale programs of the 60s and 70s for basic water and sewage service to serviceable communities in Ontario are now virtually complete. Substantial progress has also been made in reducing conventional pollutant loadings to the Great Lakes from industry. While these major activities are winding down, heightened public awareness and concern about potentially hazardous contaminants in the Great Lakes and elsewhere must be addressed through program redirection. Ministry of the Environment policy and program directions have, therefore, increasingly been focussed on the "contaminants issue". Initiatives are being taken both to further reduce contaminant emissions, and to enhance the protection of drinking water. At the same time maintenance of high levels of control at existing water and waste treatment facilities is being encouraged.

CONTROLLING THE DISCHARGE OF CONTAMINANTS

Efforts are now being directed at ensuring that performance of existing facilities is maintained at a high level, and that avenues for further reducing the discharge of identified hazardous contaminants are explored and the necessary control measures taken.

New Ministry initiatives include:

- Intensified characterization of industrial effluents including the use of biomonitoring techniques to identify hazardous contaminants
- Enforcement of a strict manifest system to ensure the safe transport and disposal of hazardous wastes at approved facilities
- Promotion of industrial plant modernization, better water management practices, substitution of process chemicals and treatment systems to further restrict contaminant inputs

- Assistance to municipalities in finding cost-effective solutions in the area of combined sewer overflows, storm-water management and the control of industrial inputs to municipal systems
- Continued research into improving treatment process efficiencies along with provision of technical support and training programs for treatment plant operators
- Streamlining monitoring programs to speed the assessment of compliance with effluent requirements
- Further controls on phosphorus inputs to the lower lakes as required under the new provision of the Great Lakes Water Quality Agreement

PROTECTING DRINKING WATER QUALITY

The Ministry is currently updating its policy on treatment requirements for waterworks to conform with the revised Ontario Drinking Water Objectives. Implementation of these policies may mean retrofitting of water works at some locations in the Province to meet the new requirements. Other initiatives include:

- Participation on the Federal/Provincial Working Group on Drinking Water Quality to revise and add to the "Guidelines for Drinking Water Quality - 1978"
- Addition of new substances to the interim priority list of Hazardous Contaminants in Drinking Water which is used, along with the Ontario Drinking Water Objectives, to evaluate acceptability of water supplies
- Continuing evaluation of improved treatment technology and the effects of this technology on contaminant removal and treatment product formation. Research is continuing in such areas as:

- o the use of ozonation and other chemicals as alternative disinfectants to chlorine;
 - o procedures to optimize conventional water treatment processes for the highest removal of trace organics;
 - o the use of granular activated carbon filtration as an add-on system (a pilot GAC facility has recently been installed at the Niagara Falls Waterworks).
- Expansion and updating of contaminant monitoring programs on drinking water. In 1984/85 thirty-five municipal waterworks (serving 70% of the Ontario population on municipal systems) will be examined, with monitoring for up to 110 parameters in the raw, treated and distributed water. This monitoring program will be continued and extended to other waterworks in future years and will incorporate new parameters as they emerge.
- Continued development of the best laboratory analytical methods for the quick and accurate determination of trace organics in drinking water. The Ministry's laboratory is widely recognized as a world class facility and leader in this area.
- Establishing protocols for the evaluation of alternate water treatment chemicals, coatings, linings and plastic pipes for use in contact with potable water.

CONCLUSION

Ontario is committed to the protection of the Great Lakes resource to meet the many and varied needs of its population. Progress is being made in reversing the degradation of these waters which had occurred through the middle of this century. While much remains to be done to safeguard the lakes for future generations, the Ministry of the Environment intends to meet this challenge.

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